LAND USE

Recent and Historical Land Use

Historically, native vegetation on uplands was dominated by prairie grasses, primarily big and little bluestem, Indian grass, switchgrass and side-oats grama. River slopes and valleys were forested, generally of the oak-hickory type. Now maples, elms, oaks, black walnut and eastern red cedar are abundant.

Detailed land use information exclusive for the Fox River basin was not available prior to the writing of this document. The Soil Conservation Service has published land use and erosion rate data for a combined Fox/Wyaconda rivers hydrological unit (SCS 1978, Figure lu).

Through a joint effort between the Soil Conservation Service and the Missouri Department of Conservation, land use was determined in the Clark County portion of the basin for 1939 an 1984. To facilitate this survey and a future Soil Conservation Service project, the basin was divided into nine subbasins. Aerial photographs taken in 1939 were analyzed for total acres and total acres in timber. Land use data from 1984 were derived from infrared photography; grasslands and permanent pasture could be discerned in addition to timber.

In this investigation, timber was conservatively defined as dense continuous tracts of trees unbroken by fields or disturbances such as grazing. Timbered areas with sparse canopy were not reported as timber because quality was questionable. Sparsely timbered areas were recorded as pasture. All area measurements were determined by digitizer and the computer program PADPAC.

Between 1934 and 1984, timber increased from 14% to 20% of total land use--an increase of 9,000+ acres over 45 years (Table 3). All subbasins except one underwent an increase in timber. The greatest increase occurred in the Central Hills region, particularly in the Middle Fox River, Lower Honey Creek, Lower Little Fox River and Linn Creek subbasins.

In 1984, permanent pasture and other grasslands in the basin totaled 25,813 acres, representing about 16% of the total land area. Urban and industrial areas accounted for less than one percent of the total land area (SCS 1978). Cropland, highways, and rural residential area totaled 101,485 acres (63%).

Throughout the basin, intensive farming accounts for nearly 60% of the upland land use (SCS 1978). The level topography over much of the region is conducive to this activity. By contrast, river slopes, particularly in the Kahoka Hills region and some prairie areas, contain large tracts of permanent pasture and/or continuous meadow.

Erosion data are available for uplands from the combined Fox/Wyaconda rivers hydrological unit (SCS 1978). Croplands lost 12.5 tons/acre/year, accounting for 73% of the gross erosion. Grasslands/pastures lost 9.9 tons/acre/year while grazed forests lost 3.5 tons/acre/year. Human

agricultural activities accounted for 99% of all upland erosion. Of the approximately 10.2 tons/acre of eroded land that were lost each year, approximately 3 tons/acre were delivered to the Fox and Wyaconda rivers (SCS 1978). Sheet and gully erosion were responsible for 84 and 12% of the sediment discharged to streams, respectively.

Fox River, Sugar Creek, Honey Creek and several drainage ditches in the Alluvial Plain are leveed. Sugar Creek and Honey Creek are entirely channelized through this region. Drainage in the basin is strictly controlled by the levee system returning water to either Fox River through Hemp Slough or the Mississippi River through pumphouses. The resulting drainage allows for the floodplain areas to be used intensely for agricultural purposes.

Soil Conservation Projects

To date, one soil conservation project has been prepared for the basin under authority of the Watershed Projection and Flood Prevention Act, P.L. 83-566. The project was to treat 55,515 acres in the Honey and Sugar creek subbasins through a series of flood retarding structures. The project became inactive in about 1972 as several of the dams became economically unfeasible. Later, lacking sufficient support for a potable water supply lake for Kahoka, the watershed district abandoned the project.

One Special Area Land Treatment (S.A.L.T) project was initiated in 1984 for the upper Honey Creek drainage southeast of Kahoka. The project was to treat 6,118 acres in the Honey and Sugar Creek watersheds. This was the first attempt in Missouri to implement an accelerated land treatment program (Dwight Snead, SCS, personal communication). The project was abandoned in 1985 due to economics and a general lack of interest by local landowners.

Flood control has often been a source of controversy in the basin. At various times students have been requested or initiated by federal, state, and local agencies to determine the feasibility of water control projects. The first such attempt was made by U.S. Army Corps of Engineers in 1942 (COE 1942). The report emphasized the need for flood control structures and suggested further study to determine their feasibility. However, the requirements of local cooperation could not be met, therefore, no studies were initiated.

In 1951, another report was prepared for Congress by the Corps of Engineers in the interest of flood control and drainage on Fox River, primarily in Iowa. The Chief of Engineers advised against the improvements outlined in the document (COE1951).

In 1958, the Iowa Natural Resources Council prepared an inventory of streams in southern Iowa and commented on their associated water problems (INRC 1958). General recommendations were made in regard to data collection and water control on Fox River. No actions were carried out by that agency.

A seven-year feasibility study was conducted by the U.S. Army Corps of Engineers in the early 1970's to investigate various flood control options (COE 1972). In the original proposal, five dams were considered for Honey and Sugar creeks in addition to channel alterations and extensive levee work on

Fox River and some of its tributaries. After years of deliberation and study, the feasibility report was released in 1979. With the expiration of the notice period, the Board of Engineers for Rivers and Harbors determined the project to be economically unjustified. Since that time, Corps of Engineers involvement in water control has largely been limited to repair of existing levees in the lower Honey and Sugar creek subbasins.

Corps of Engineers Jurisdiction

The Fox River basin is under regulatory jurisdiction of the Rock Island District. The entire Missouri portion of Fox River and the Little Fox River to S15, R9W, T66N, Clark County, were within the jurisdictional boundaries defined by the former Corps of Engineers 5 cfs median flow limitation (Figure 5). The boundary on the Little Fox River has been expanded, however, to now include the entire Missouri portion due to Federal Regulations 33 CFR 320-329 (1977), which provides for Corps of Engineers jurisdiction on the entire length of all streams in the United States.

Public Areas

A total of 5,682 acres in the basin are in public ownership (Figure pa). Stream anglers have access to over ten miles of public frontage (Table 4).

The largest frontage tract available in the basin is at Charlie Heath State Forest and Memorial Wildlife Area which includes 3.85 miles of Fox River. The stream, suitable for bank fishing and wading, provides anglers with the opportunity to fish for several species, primarily channel and flathead catfish.

Recently acquired by the Unites States Fish and Wildlife Service, the Gregory Landing tract was added to the Mark Twain National Wildlife Refuge. Nearly 2.5 miles of Fox River will be available for bank and small craft fishing.

Over 1½ miles of frontage are available on Nixon Branch at the Clark State Forest near Chambersburg. Nixon Branch, however, is an intermittent stream that does not support a sport fishery. Slightly more than one mile of stream frontage can be found at the Linn Creek tract. This stream, though considered to have permanent flow, does not support a sport fishery. Nearly one mile of stream frontage is available at Fox Valley State Forest north of Kahoka.

Of two stream access sites identified in the basin (Gann 1989), one has been developed. The Geode Access, completed in 1989, is located west of Wayland off U.S. Highway 136 (NW 1/4, S31, R6W, T65N) encompassing ½ acre of land and less than 1/10th mile frontage on Fox River. A proposed acquisition site is located approximately 14 miles upstream, 2½ miles north of Kahoka on Fox River just above its confluence with the Little Fox River (S2, R8W, T65N).

Recreational Use

Because it is small and far from large urban areas, Fox River has a relatively low recreational standing among Missouri watersheds; however, recreational use is expected to increase (Bachant and Martindale 1982).

Stream-related activities in the basin are largely restricted to hunting and fishing. Boating and canoeing on all tributaries and most of Fox River is hampered by shallow water, log jams, insufficient flow, and inaccessibility. Siltation and occasional periods of turbidity discourage swimming.

Fox River receives moderate fishing pressure relative to other Mississippi River tributaries in northeastern Missouri (Table 5). Channel catfish are targeted b 69% of Fox River's anglers; bullheads, carp and crappie are sometimes sought. Channel catfish catch and harvest rates are considered good but rank low compared to other northeastern Missouri streams. Anglers rated the quality of catfishing in Fox River poor (2.6 on a 10 point scale).

Land Use, Habitat, Fishery Corollary

Land use has affected basin hydrology, channel morphology, water quality, habitat and ultimately fish populations. To mitigate for habitat and/or species loss, it is essential to know what has been lost and how the ecosystem formerly functioned. Detailed historical accounts of stream habitat and biota do not exist for Fox River and its tributaries. However, local residents in the basin often recall an era when Fox River was deeper and cleaner, with higher sustained flows and larger fish.

Many changes have occurred in the basin that would seem to support the above observations, most resulting from agricultural activity. The conversion of grasslands to row crops reduced filtration and water retention capacity of the watershed because of topsoil loss, soil compaction, and reduction in soil organic content. Also, from 1939 to 1984 the proportion of forest cover in the watershed increased appreciably, mostly on moderate upland slopes. The original cover type on these slopes was prairie grass, which probably served better as a filter than whatever forest has replaced it.

One consequence of intensive agriculture has been an adversely affected hydrologic regime. Although the average annual flow in Fox River showed no trend toward reduced volume (Figure 7), empirical duration curve data suggest that Fox River has become more susceptible to desiccation (Figure 8c) and perhaps to flash flooding. This is not to say that spates and no-flow periods did not occur historically, but an increasing tendency toward desiccation during late summer probably results from increased evaporation from basin impoundments and from compacted soils which lack the organic matter and overall water retention capacity they possessed prior to intensive agriculture.

Another consequence of agriculture has been the increased rate of stream channel sedimentation. Although some upland erosion and sedimentation rate information exists for the Fox/Wyaconda river basins (SCS 1978), the rate of sediment transport in stream channels has not been determined. Stream upland slopes in the basin were probably forested and subsequently logged, grazed or plowed upon the

arrival of mechanized agriculture. By 1939, sediment discharged to Fox River was probably more severe than at any time prior to or since mechanized agriculture. Some problems in the basin today (i.e. shallow water, unstable substrates, low productivity) may be a consequence of land use in the 1930s and 1940s.

Sedimentation coupled with the "flashy" nature of stream flow in the basin have probably increased turbidity and altered water quality parameters important for fish growth and survival. Lack of deep water may partially explain the movement of smallmouth bass from nursery areas in Fox River to the Mississippi River as juveniles. Adult smallmouth bass exhibit a preference for water 3 feet deep (USFWS 1983). The sedimentation of former riffles has destroyed crayfish habitat which may in turn limit smallmouth bass distribution.

Another potential consequence of intensive agriculture is the alternation of fish behavior. Most stream organisms rely upon the cues provided by a somewhat predictable hydrological regime to initiate certain behaviors. If regimes become less predictable, a loss in species diversity could occur over time. The extirpation of the Missouri silvery minnow may have been caused by a change in the hydrological regime. Furthermore, spates and droughts may negatively affect gravel bed habitats like those found in the Kahoka Hills, resulting in lower fish standing crop and shifts in trophic structure (Resh et.al. 1988).

Other anthropogenic disturbances have compounded fishery problems in the basin. Extensive channelization in the Alluvial Plain has resulted in poorer habitat and fish populations than in Kahoka Hills streams. Channelized reaches are characterized by less cover, shallow and warm water, unstable substrate and thin riparian corridors. Fish communities are dominated by omnivores, generalist species; sport fish are few and small.

No clear trend was detected when comparing fish populations in narrow wooded corridors versus wide wooded corridors at unchannelized sites. This suggests that the effects of riparian corridor thickness on fish populations may not be site-specific, even though basin-wide effects may be significant.

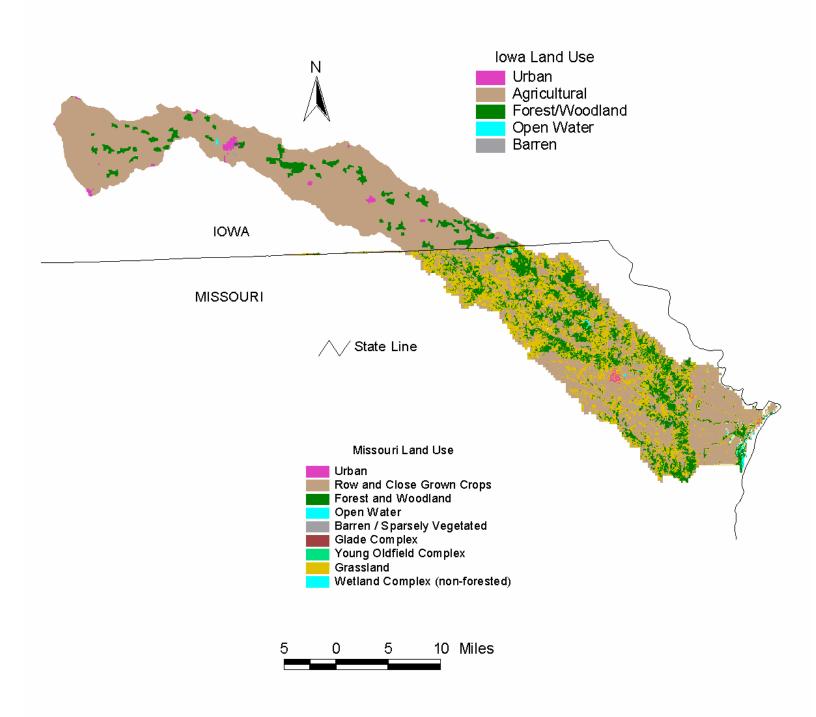


Figure lu. Land use/land cover within the Fox River watershed in Missouri and Iowa (MORAP 1999, preliminary data).

Table 3. Changes in Forest Cover in the Fox River Basin, 1939-84

	Percentag	ge Timber	Percentage	
Subbasin	Total Acres	1939	1984	Change
Linn Creek	11,340	12.5	19.2	+6.7
Lower Fox River	20,765	5.8	11.7	+5.9
Lower Honey Creek	21,232	13.9	21.5	+7.6
Lower Little Fox	9,375	28.5	35.3	+6.8
Middle Fox River	31,662	18.3	26.2	+7.9
Sugar Creek	11,431	13.6	17.9	+4.3
Upper Fox River	24,820	22.8	28.7	+5.9
Upper Honey Creek	19,216	2.9	2.7	-0.2
Upper Little Fox	11,641	12.9	18.5	+5.6
Average:		14.4	20.2	+5.8

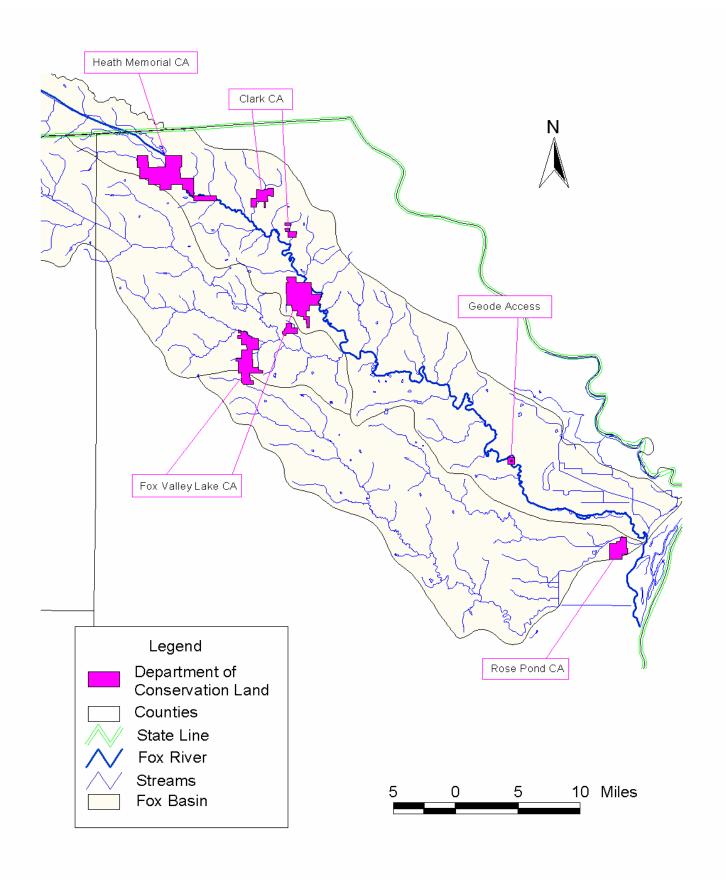


Figure pa. Public areas in the Fox River Basin, in Missouri. CA = Conservation Area

Table 4. Public Stream Access and Frontage Areas in the Fox River Basin.

Area	Acres	Stream Frontage Miles	Stream				
Charlie Heath S.F.	1,530	3.85	Fox River				
Clark S.F.	1,167	2.60	Nixon Branch				
			Linn Creek				
Fox Valley S.F.	1,568	0.99	Fox River				
Mark Twin N.W.R.	1,038	2.47	Fox River				
Rose Pond N.H.A.	379	0.37	Honey Creek				
Goede Access	<1	<.10	Fox River				

Legend: S.F. = State Forest (MDC) N.W.R. = National Wildlife Refuge (USFWS)

N.H.A. = Natural History Area (MDC)

Table 5. Sport Fishery Characteristics of the Fox River and Other Northeastern Missouri Streams, Based Upon a Statewide Angler Telephone Survey, 1983-1986.

River	ANGLERS	PREFCAT	PREFANY	PREFOTR	%PREFCAT	CATCHRT	HARVRT	FISQUAL
Des Moines	58	48	10	0	83	0.98	0.70	5.3
Fabius	86	63	14	9	74	0.85	0.68	4.9
Fox	38	26	3	9	69	0.70	0.29	2.6
North	27	21	4	2	78	0.89	0.78	4.3
Salt	408	292	68	48	72	0.41	0.31	4.3
Wyaconda	13	2	1	10	16	0.75	0.00	2.0

Legend: ANGLERS - Total number of anglers who fished each river.

PREFCAT - Total number of anglers who fished for catfish.

PREFANY - Total number of anglers who fished for anything.

PREFOTR - Total number of anglers who fished for other species.

%PREFCAT - Percent of total anglers who fished for catfish.

CATCHRT - Catfish catch rate by anglers who fished for them.

HARVRT - Catfish harvest rate by anglers who fished for them.

FISQUAL - Survey participants evaluation of the quality of their catfishing trip.